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material substantially the same thereby providing a band gap in said n-type clad layer that is substantially the same as a band gap in said barrier layers.

REMARKS

Attached hereto is a petition and fee for a one-month extension of time.

Also attached hereto is a marked up version of the changes made in the specification and/or claims by the current Amendment. The attached page is captioned "**Version with markings to show changes made.**"

It is noted that the claim amendments herein are intended solely to more particularly point out the present invention for the Examiner, and not for distinguishing over the prior art or the statutory requirements directed to patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1 and 4-15 are all of the claims pending in the present Application. Claims 8-15 have been added to more completely define the invention. Claims 1 and 4-6 stand rejected under 35 USC §102(e) as anticipated by US Patent 5,959,307 to Nakamura et al. Claim 7 stands rejected under 35 USC §102(e) as anticipated by Nakamura or, alternatively, as rejected under 35 USC §103(a) as being unpatentable over Nakamura

These rejections are respectfully traversed in view of the following discussion.

I. The Claimed Invention

As described and claimed, for example by claim 1, the present invention is directed to a group III nitride compound semiconductor light-emitting device including a light-emitting layer of a multilayer quantum well structure including alternately laminated well layers and barrier layers and an n-type clad layer being in contact with the light-emitting layer. The n-type clad layer is made thicker than each of the barrier layers and the thickness of the n-type clad layer is in a range of 100 Å to 500 Å. The n-type clad layer is formed of a material substantially the same as the barrier layers, thereby providing a band gap in the n-type clad

layer that is substantially the same as a band gap in the barrier layers.

With such unique and unobvious features, high light intensity is provided by securing the effect of confining carriers sufficiently in the light-emitting layer while keeping color purity intact.

II. The Prior Art Rejections

The Examiner alleges that US Patent 5,959,307 to Nakamura et al anticipates or renders obvious the present invention as described by claims 1 and 4-7. However, Applicants respectfully disagree.

A key feature of the present invention, as described by claim 1 is that, as described by lines 3-5 of page 9 of the specification, the barrier layers and n-type clad layer are made of substantially the same material, by reason that the barrier layers are formed using "the same condition as used for forming the n-type clad layer". This "same condition" for manufacturing means that, not only are the same materials used for both the barrier layers and the n-type clad layer, but also the doping levels and, therefore, the band gaps are substantially the same for both the barrier layers and the n-type clad layer.

This characteristic in which the barrier layer and n-type clad layer have substantially the same band gap is clearly and precisely defined in the claimed invention and is not suggested in the Nakamura reference.

That is, as best understood, the Examiner's position is that the materials described in Nakamura and the ranges described therein could cover the case of the present invention as described by claim 1. However, Applicants respectfully disagree that the mere listing of materials and ranges in Nakamura in any way anticipates or renders the present invention obvious.

It is a time-honored doctrine that an invention may be non-obvious, even if it includes only elements already known in the art, simply because the invention is a new combination of known elements. Specifically, in the present case, even assuming that the materials and ranges discussed in Nakamura are considered known in the art, there is no suggestion to combine these materials and ranges in the combination of the present invention as claimed.

That is, the barrier layer in Nakamura is described in column 6 at lines 15-17, 28-32,

47-48, 52-53, and 56-65. However, these descriptions convey only details of ranges or differences. Nowhere is there even a suggestion that the barrier layer be similar to any other layer, let alone that the barrier layer be substantially the same in composition and band gap to the n-type clad layer.

In order to achieve the present invention described by claim 1, the technique in Nakamura would have to be modified to describe a barrier layer as being at least similar to the n-type clad layer. Not even a hint of such suggestion to make such modification exists in Nakamura. Nor does the Examiner provide a reference that makes such suggestion.

MPEP 2143.01 very clearly states that for a *prima facia* case of obviousness, "the prior art must suggest the desirability of the claimed invention" (subtitle of MPEP 2143.01). This section additionally states, citing *In re Mills*, 916 F.2d 680, 16 USPQ 2d 1430 (Fed. Cir. 1990), that "the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination" (emphasis in MPEP).

There is clearly no suggestion in Nakamura that the barrier layer even be similar to the n-type clad layer.

Additionally, the energy band diagram shown in Figure 5 clearly shows that no band gaps are expected in Nakamura to be substantially equal to that of the barrier layer, let alone that the barrier layer and n-type clad layer specifically have substantially the same band gap.

Moreover, in view of the main subject of Nakamura, one of ordinary skill in the art would not likely (let alone obviously!) make the n-clad layer 201 of substantially the same material as that of the barrier layers 16. That is, as discussed on line 48 to 52 in column 4, Nakamura aims at the effective tunnel effect whereby the electrons will be effectively injected from the third layer to the active layer while preventing the overflows of the electrons from the active layer by blocking the active layer with the first n-clad layer having a large band gap as illustrated in Figure 5.

Even if the n-type clad layer has a large band gap, its thickness is reduced in Nakamura to achieve the effective tunnel effect. It would be hard to achieve the two conflicting functions, tunnel effect and overflow prevention, by making the n-type clad layer with the same material as that of the barrier layers because reducing the thickness of the layer is

advantageous to tunnel effect but disadvantageous to overflow reduction.

There is no suggestion in Nakamura to reconcile these two conflicting functions and, thus, Nakamura teaches away from the claimed invention.

Hence, turning to the clear language of the claims, there is no teaching or suggestion that " ... said n-type clad layer is formed of a material substantially the same as said barrier layers, thereby providing a band gap in said n-type clad layer that is substantially the same as a band gap in said barrier layers."

For the reasons stated above, the claimed invention is fully patentable over the cited reference.

Further, the other prior art of record has been reviewed, but it too even in combination with the Nakamura reference, fails to teach or suggest the claimed invention.

III. Formal matters and Conclusion

In view of the foregoing, Applicant submits that claims 1 and 4-15, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: 1/16/03

Frederick E. Cooperrider
Reg. No. 36,769

McGinn & Gibb, PLLC
8321 Old Courthouse Road, Suite 200
Vienna, Virginia 22182
(703) 761-4100
Customer No. 21254

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

The claims have been amended, as follows:

1. (Three Times Amended) A group III nitride compound semiconductor light-emitting device, comprising:

a light-emitting layer of a multilayer quantum well structure composed of alternately laminated well layers and barrier layers; and

an n-type clad layer being in contact with said light-emitting layer,

wherein said n-type clad layer is made thicker than each of said barrier layers and the thickness of said n-type clad layer is in a range of 100 Å to 500 Å, and

wherein said n-type clad layer is formed of a material substantially the same as said barrier layers, thereby providing a band gap in said n-type clad layer that is substantially the same as a band gap in said barrier layers.

The following new claims have been added:

8. (New) The semiconductor light-emitting device of claim 1, wherein a thickness of said well layer is approximately 30 Å and a thickness of said barrier layer is approximately 70 Å.

9. (New) The semiconductor light-emitting device of claim 1, further comprising:

a cap layer formed on said light-emitting layer; and

a p-type clad layer formed on said cap layer.

10. (New) The semiconductor light-emitting device of claim 9, wherein a thickness of said p-type clad layer is in a range of 180 Å to 500 Å, and a light emitted comprises green light in a wavelength range of 510 nm to 530 nm.

11. (New) The semiconductor light-emitting device of claim 10, wherein said thickness of said p-type clad layer is in a range of 240 Å to 360 Å.

12. (New) The semiconductor light-emitting device of claim 9, wherein a thickness of said p-type clad layer is in a range of 90 Å to 390 Å, and a light emitted comprises blue light in a wavelength range of 460 nm to 475 nm.

13. (New) The semiconductor light-emitting device of claim 12, wherein said thickness of said p-type clad layer is in a range of 120 Å to 300 Å.

14. (New) The semiconductor light-emitting device of claim 9, wherein said p-type clad layer comprises p-type doped $Al_xGa_{1-x}N$, where x ranges from 0.10 to 0.14.

15. (New) A group III nitride compound semiconductor light-emitting device, comprising:

a light-emitting layer of a multilayer quantum well structure composed of alternately laminated well layers and barrier layers; and

an n-type clad layer being in contact with said light-emitting layer,

wherein said n-type clad layer is made thicker than each of said barrier layers, said n-type clad layer is formed of a material substantially the same as said barrier layers, said material substantially the same thereby providing a band gap in said n-type clad layer that is substantially the same as a band gap in said barrier layers.